Concentration in Local Commercial Banking Markets: A Study of the Eighth Federal Reserve District

PATRICK J. WELCH

CONCENTRATION measures indicate the extent to which some specific magnitude, such as total deposits, sales or capacity, is controlled by one or a few decision-making units in a market. At the firm level, which is the focus of this study, concentration depends on the number of firms in the market and their relative sizes.[1] Accordingly, the fewer the banking organizations in a local commercial banking market or the more unevenly deposits are distributed among a given number of organizations within a market, the higher the concentration in that market.

The degree of market concentration is important because it may affect the overall "performance" of the market — the extent to which firms in the market act independently, aggressively adopt new technologies, provide desired types and levels of services and carry out other activities that benefit buyers, suppliers and others. While the existence of a systematic link between concentration and performance is open to debate, there are many, including the U.S. Department of Justice, who believe that a high level of concentration in a market will affect the market's performance adversely.[2] Thus, if a market is characterized as being highly concentrated, some form of policy intervention may be proposed to monitor or modify market performance.

The concentration of total deposits among banking organizations in 176 Eighth District local commercial banking markets is described in this study.[3] Also described is the distribution of observed levels of concentration according to a recently published Department of Justice criterion for classifying markets as highly concentrated, moderately concentrated and unconcentrated. Finally, the effects on concentration due to

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The author is a professor of economics at Saint Louis University. *Thanks go to Jude Naes for programming and research assistance, and to Barbara Scott Brumley for research assistance.*

[1]Concentration also can be measured at the plant level.

[2]The Department of Justice, in its June 1982 merger guidelines, noted that:

> Other things being equal, concentration affects the likelihood that one firm, or a small group of firms, could successfully exercise market power. The smaller the percentage of total supply that a firm controls, the more severely it must restrict its own output in order to produce a given price increase, and the less likely it is that an output restriction will be profitable. Where collective action is necessary, an additional constraint applies. As the number of firms necessary to control a given percentage of total supply increases, the difficulties and costs of reaching and enforcing consensus with respect to the control of that supply also increase.

U.S. Department of Justice, "Merger Guidelines," *Federal Register* (June 30, 1982), p. 28497.

For more on the concentration-performance relationship, see Donald R. Fraser and Peter S. Rose, "Banking Structure and Performance in Isolated Markets: The Implications for Public Policy," *The Antitrust Bulletin* (Fall 1972), pp. 927–47; Arnold A. Heggestad and John J. Mingo, "Prices, Nonprices, and Concentration in Commercial Banking," *Journal of Money, Credit and Banking* (February 1976), pp. 107–17; Almarin Phillips, "Competition, Confusion, and Commercial Banking," *The Journal of Finance* (March 1964), pp. 32–45; and Thomas R. Saving, "Concentration Ratios and the Degree of Monopoly," *International Economic Review* (February 1970), pp. 139–46.

[3]Banking organizations included in the study are unit banks, multibank holding companies and branch banking organizations. Chain banking relationships arising through common ownership or management interlocks are not considered due to data limitations. Thus, observed levels of concentration may understate the effective degree of control in particular markets.

For other studies of the relationships among banking organizations in the Eighth District, see Gerald P. Dwyer, Jr., and William C. Niblack, "Branching, Holding Companies, and Banking Concentration in the Eighth District," this *Review* (July 1974), pp. 11–23; Ross M. Robertson, "The Structure of Banking in the Eighth District: Branches and Mergers," this *Review* (April 1956), pp. 45–51; and Ross M. Robertson, "The Structure of Banking in the Eighth District: Chains, Groups and Interindustry Competition," this *Review* (October 1956), pp. 113–21.

demand in local commercial banking markets, differences in state laws allowing branching and multibank holding companies, and physical space within local markets are considered.

The study is divided into three sections: First, definitions and the measure of concentration are introduced. Second, the concentration of total deposits among banking organizations in local commercial banking markets is reported and analyzed.[4] A summary and conclusions are then presented.

THE MEASUREMENT OF CONCENTRATION

Concentration and the Definition of Relevant Commercial Banking Markets

Market boundaries separate sellers who compete directly from those with whom there is no direct competition. Consequently, the measure of concentration in a market depends in a critical way on the manner in which the boundaries of the market are defined. All else equal, the more narrowly defined the market, the higher the measured concentration for a specific number of firms.

The definition of a market's boundaries depends on two considerations: the products that are judged to be close substitutes and the geographic space over which the producers of those products compete for the same buyers.[5] In this study, the product analyzed is commercial banking services. While this specification is narrower than if thrifts were included, it is chosen because commercial banking, considered as a separate line of commerce, is the point of reference in court decisions and Federal Reserve System guidelines that affect bank market concentration.[6]

The geographic boundaries of markets in this study are those established by the Federal Reserve Bank of St. Louis in its analysis of bank holding company and bank merger applications. A frequent alternative to this approach is to define banking markets along county or Standard Metropolitan Statistical Area (SMSA) lines.[7] This alternative, however, is rejected under the assumption that market boundaries need not coincide with political boundaries.[8]

The Selection of a Concentration Measure

Once the relevant markets are defined, the concentration measure must be selected and its quantitative value obtained for each market.

Because concentration measures are based on the behavior of a single variable, such as capacity, value added or sales, the results and rankings obtained using one variable may differ from those obtained using another. This is especially a problem when dealing with commercial banks, which are multiproduct firms

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[4]Deposits in banking organizations in the 176 observed markets are evaluated as of June 30, 1981, and come to $51.31 billion, or 86.99 percent of the $58.98 billion total deposits in the Eighth District on that date. The balance of the deposits is from areas within the Eighth District where specific markets were not defined. Foreign deposits are not included in the calculation of total deposits.

Total deposit data are from "Report of Condition," June 30, 1981, and "Summary of Deposits," June 30, 1981, compiled by the Federal Deposit Insurance Corporation. Data on multibank holding companies and branch relations are from "Bank and Branch Structure File," June 30, 1981, compiled by the Board of Governors of the Federal Reserve System from secondary sources.

[5]For studies treating market definition criteria, see Deane Carson and Paul M. Horvitz, "Concentration Ratios and Competition," *The National Banking Review* (September 1963), pp. 105–10; Stephen A. Rhoades, *Structure-Performance Studies in Banking: A Summary and Evaluation*, Staff Economic Studies 92 (Board of Governors of the Federal Reserve System, 1977); Michael E. Trebing, "The New Bank-Thrift Competition: Will It Affect Bank Acquisition and Merger Analysis?" this *Review* (February 1981), pp. 3–11; and David D. Whitehead, "Relevant Geographic Banking Markets: How Should They Be Defined?" Federal Reserve Bank of Atlanta *Economic Review* (January/February 1980), pp. 20–28.

[6]For example, in a Board of Governors memo on the consideration of thrifts in competitive analysis, it was concluded that:

> The present general framework of competitive analysis should continue, with initial consideration always of competitive effects on the structure and performance of commercial banking alone. . . .

Letter, William W. Wiles, Associate Director, Division of Banking Supervision and Regulation, Board of Governors of the Federal Reserve System, to the officers in charge of Examinations, Legal, and Research Departments at all Federal Reserve Banks, June 25, 1980.

For examples and explanations of the courts' definition of commercial banking as a separate line of commerce, see *United States v. Philadelphia National Bank*, 374 U.S. 321, 355–57 (1963); *United States v. Connecticut National Bank*, 418 U.S. 656, 660–66 (1974); and *United States v. First National State Bancorporation*, 499 F. Supp. 793, 799-801, 810–11 (D.N.J. 1980).

[7]For a summary of alternative geographic market definitions in banking structure-performance studies, see Rhoades, *Structure-Performance Studies*, appendix table.

[8]The distinction between the county/SMSA market definition and the definitions used in this study may be more important in principle than in effect. Of the 176 banking markets examined, 99 (56.25 percent) coincide with single counties, 24 (13.64 percent) coincide with two or more whole counties, and 53 (30.11 percent) coincide with parts of individual counties, whole counties plus parts of other counties or Ranally Metropolitan Areas.

and thus offer a wide range of variables as potential candidates for evaluation. This study focuses on total deposits in commercial banks because of its importance in Federal Reserve Board policy decisions that affect concentration in commercial banking markets.[9]

The concentration of total deposits in each local market is calculated using a Herfindahl index (H-index), which is the sum of the squared market shares of the organizations in the market.[10] Each banking organization's share of a market is equal to the percentage of total deposits in the market that it controls.

The H-index is chosen over other concentration measures for three reasons. First, the recently published Department of Justice merger guidelines rely primarily on the H-index to measure concentration.[11] Second, unlike other widely used concentration measures, the H-index is explicitly sensitive to the impact on concentration of the number of sellers in a market and their relative sizes.[12] Third, H-index numbers translate conveniently into "numbers-equivalents," which are useful for making intermarket comparisons of concentration. The numbers-equivalent is the number of equally sized sellers that would generate an H-index value equal to the observed value.[13]

ANALYSIS OF LOCAL MARKET CONCENTRATION

Summary of Concentration in Local Commercial Banking Markets

On the basis of its H-index value, each local commercial banking market in the Eighth District is placed into one of 15 concentration categories. These categories, along with their respective H-index value ranges and the numbers-equivalents indicating the least concentrated market consistent with placement in each category, are listed in table 1. Also listed in table 1 is the distribution of all 176 markets among H-index categories, the distribution among categories of markets in each state, and the distribution among categories of markets that cross state lines. For all markets taken together, the mode category is H4 (the equivalent of from 3 to 2 equal-sized banking organizations in a market), and the median is in category H5 (the equivalent of from 4 to 3 equal-sized banking organizations in a market).

The extent of concentration in the observed banking markets can be further categorized according to the Department of Justice guidelines for evaluating horizontal mergers. Markets with H-index values less than 0.10 are considered to be "unconcentrated," markets with H-index values greater than 0.18 are considered to be "highly concentrated," and markets with H-index values between 0.10 and 0.18 are considered to be "moderately concentrated."[14] This categorization is listed in the right-hand column of table 1.

Generally, as illustrated in table 1, local commercial banking markets in the Eighth District are highly concentrated by the Department of Justice criterion: over 80 percent of the markets studied fall into the highly concentrated group. Several factors that help explain why concentration is higher in some markets than in others are discussed below.

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[9]See, for example, orders on bank holding company cases published in the *Federal Reserve Bulletin*.

[10]H-index = $\sum_{i=1}^{n} \left(\frac{td_i}{TD}\right)^2$, where td_i is total deposits in the ith commercial banking organization in a market, TD is total deposits in all commercial banking organizations in that market, and n is the number of banking organizations in that market. The H-index can assume a value of from 1/n through 1. As a market becomes more concentrated, either through a decrease in the number of sellers or a widening inequality among a given number of sellers' market shares, the H-index number approaches 1.

For discussions of concentration measures, see "Measures of Banking Structure and Competition," *Federal Reserve Bulletin* (September 1965), pp. 1212–22; and Christian Marfels, "A Bird's Eye View to Measures of Concentration," *The Antitrust Bulletin* (Fall 1975), pp. 485–503.

[11]U.S. Department of Justice, "Merger Guidelines," p. 28497.

[12]Top level concentration measures (e.g.: three-firm, four-firm or eight-firm concentration ratios and curves) focus primarily on the market shares of the largest firms with passing, if any, consideration of smaller sellers in a market. Lorenz curves measure inequality in the distribution of market shares, with no particular reference to the number of sellers in a market.

It should be noted that the greater sensitivity of the H-index does not necessarily make it superior to other measures of concentration. The appropriateness of any measure must be judged according to the theoretical relationship it is describing.

[13]The numbers-equivalent is the reciprocal of the Herfindahl index number: 1/H-index.

[14]The "unconcentrated," "moderately concentrated" and "highly concentrated" distinctions are based on post-merger H-index values. The Department of Justice has indicated that it is unlikely to challenge mergers in markets where the post-merger H-index value is less than 0.10; unlikely to challenge mergers that increase the H-index value by less than 0.01 in markets where the post-merger H-index value is between 0.10 and 0.18; and unlikely to challenge mergers that increase the H-index value by less than 0.005 in markets where the post-merger H-index value is greater than 0.18. The Department of Justice also has identified other factors that are of consequence in evaluating the effects of horizontal mergers. See U.S. Department of Justice, "Merger Guidelines," pp. 28496–99.

Table 1

Distribution of Local Commercial Banking Markets Among Herfindahl Index and Department of Justice Concentration Categories

Category	H-Index Value Range	Numbers-Equivalent (maximum number of equal-sized firms)	All Markets	States AR	IL	IN	KY	MS	MO	TN	I.M.[1]	Dept. of Justice Categories
H1	1.0	1	2						2			Highly concentrated (147 markets)
H2[2]	0.55556 to 1.0	1.8	3	1			1		1			
H3	0.5 to 0.55556	2	14	7		2	2		3			
H4	0.33333 to 0.5	3	50	6	6	1	9	9	15	3	1	
H5	0.25 to 0.33333	4	40	6	3	3	8	4	11	4	1	
H6	0.2 to 0.25	5	34	5	8		3	5	9	1	3	
H7	0.18 to 0.2	5.556	4	2			1				1	
H8	0.16667 to 0.18	6	5		1		1		2	1		Moderately concentrated (24 markets)
H9	0.14286 to 0.16667	7	10	1	1	2			3	1	2	
H10	0.125 to 0.14286	8	5	1	2			1			1	
H11	0.11111 to 0.125	9	2							1	1	
H12	0.1 to 0.11111	10	2		1				1			
H13	0.08333 to 0.1	12	4	1	2						1	Unconcentrated (5 markets)
H14	0.07143 to 0.08333	14										
H15	0.0625 to 0.07143	16	1								1	
Totals			176	30	24	8	25	19	47	11	12	

[1]Interstate markets

[2]H-index = 0.55556 is the Herfindahl value associated with a two seller market, where one seller is twice as large as the other.

What Factors Influence the Extent of Concentration?

Concentration and Demand — One factor that can influence concentration is the level of demand in a market. All other things equal, lower demand would be expected to lead to fewer sellers and greater concentration in a market. Such a relationship can be explained on efficiency grounds. Operation below some specified level of output prevents a seller from fully exploiting the scale economies that allow unit costs to fall as output increases. Such scale economies result, for example, from the utilization of specialized inputs, or efficiencies from consolidating previously separate activities. The level of output at which scale economies are exhausted (i.e., at which unit costs are minimized) is termed the "minimum efficient scale," and the number of sellers that can achieve that level of output is influenced by the size of the market as measured in terms of demand: the greater the demand in a market, the greater the number of sellers achieving minimum efficient scale it can accommodate. As a result of this interaction between scale economies and demand, there is an upper limit on the number of sellers which can operate at or above a minimum efficient level of output in a market.

In this study, total population in the market is used as a proxy for market demand: the greater the population, the greater the demand.[15] The distribution of Eighth District local commercial banking markets according to total population is shown in table 2.

To test for the effect of demand on concentration, a simple statistical procedure is used. One hypothesis,

[15]Population and related data are from *1982 Commercial Atlas and Marketing Guide* (Rand McNally and Co., 1982), pp. 94–95, 130–31, 194, 320, 374–75, 377; *Rand McNally Road Atlas* (Rand McNally and Co., 1982), pp. 26–27; Bureau of the Census, *1980 Census of Population*, Vol. 1, Characteristics of the Population (U.S. Government Printing Office, 1982), Part 5, Arkansas, pp. 5-8, 5-33; Part 15, Illinois, pp. 15-8, 15-23; Part 16, Indiana, p. 16-8; Part 19, Kentucky, p. 19-8; Part 26, Mississippi, p. 26-8; Part 27, Missouri, p. 27-8; Part 38, Oklahoma, p. 38-8; and Part 44, Tennessee, p. 44-8.

It is necessary to estimate the populations of markets that include parts of counties. For these markets, it is assumed that population is distributed evenly across each relevant county, so that the proportion of a county's physical space included in a market is equal to the proportion of that county's population included in the market.

Table 2

Distribution of Local Commercial Banking Markets by Total Population

Total Population (in thousands)	Number of Banking Markets
0 to 25	84
25 to 50	54
50 to 75	22
75 to 100	2
100 to 125	3
125 to 150	1
150 to 175	3
175 to 200	2
200 to 300	1
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400 to 500	1
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800 to 900	2
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2000 to 3000	1

Table 3

Distribution of the 88 Least Populated and 88 Most Populated Local Commercial Banking Markets by Herfindahl Index Category

Herfindahl Index Category[1]	88 Least Populated Markets	88 Most Populated Markets
H1	2	
H2	3	
H3	11	3
H4	36	14
H5	22	18
H6	13	21
H7		4
H8	1	4
H9		10
H10		5
H11		2
H12		2
H13		4
H14		
H15		1

[1]See table 1.

termed the null hypothesis, states that H-index values in the 88 smallest (least populated) markets are essentially the same, on average, as those for the 88 largest (most populated) markets. The alternative hypothesis is that H-index values in the 88 least populated markets are higher, on average, than those for the 88 most populated markets. Table 3 lists the distributions among the 15 H-index categories of markets in the 88 least populated and 88 most populated groupings.

The null hypothesis is evaluated and rejected using the chi-square approximation of the Kolmogorov-Smirnov two-sample test.[16] This result suggests that relatively higher levels of concentration can be expected in markets with smaller populations.

Concentration, State Banking Laws and Market Space — In any given market, a reorganization of sellers that reduces their number or increases the market share of one large firm generally increases the H-index value for that market. In commercial banking, the merging of two or more previously competing banks into a multibank holding company generally would increase concentration. Similarly, an increase in the number of branches in a market by a large bank would increase concentration if it draws deposits away from smaller banks. Thus, in principle, legislation allowing multibank holding companies or branching would be expected to increase concentration.

On June 30, 1981, there were several different legislative environments within which Eighth District banking organizations operated. Illinois allowed neither branching nor multibank holding companies;

[16]The chi-square approximation of the Kolmogorov-Smirnov two-sample test is $\chi^2 = \frac{4D^2(n_1 n_2)}{n_1 + n_2}$, where n_1 and n_2 are sample group sizes, and D is the maximum difference between the cumulative frequencies of the sample groups, as indicated by inspection of each of the categories in which the sample groups are compared. When the calculated test statistic is compared with values from the chi-square distribution with two degrees of freedom, the null hypothesis can be rejected at a particular level of confidence when the calculated statistic exceeds the appropriately defined chi-square value. See Sidney Siegel, *Nonparametric Statistics for the Behavioral Sciences* (McGraw-Hill Book Company, 1956), pp. 127–36.

The value of the test statistic, using a one-tailed test, is 34.57 for the 88 least populated vs. 88 most populated markets comparison. At the 0.1 percent level, this exceeds the chi-square statistic with two degrees of freedom of 13.82.

Arkansas, Indiana, Kentucky and Mississippi allowed limited branching but not multibank holding companies; Missouri allowed multibank holding companies but not branching; and Tennessee allowed both limited branching and multibank holding companies.[17]

To test for the effect of state banking laws on local market concentration, three market groupings are evaluated using multiple regression analysis. In the first grouping, the H-index values for the 164 markets that do not cross state lines are regressed on market population, a multibank holding company dummy variable and a branching dummy variable. In the second and third groupings, the H-index values for local markets are regressed on market population, the multibank holding company dummy variable, the branching dummy variable and a "square miles" variable, introduced to capture the effect on concentration of physical space within a market. All else equal, it is expected that the greater the geographic size of a market, the larger the number of firms it can accommodate, and the lower the concentration.

The space variable is measured in terms of square miles of county rather than square miles of market as defined by competitive relationships. Therefore, the second grouping is limited to the 120 Eighth District local commercial banking markets that do not cross state lines and that are made up of one or more whole counties. The third grouping is composed of 598 single counties in the states encompassing the Eighth District, except Mississippi, for which there are inadequate data.[18] Market areas within these states but outside the Eighth District are included in this grouping. It is implied in the third grouping that, in all instances, the relevant market is equal to a single county. This grouping is introduced to test the effects of state banking laws, population and space on local market concentration using an alternative criterion for defining relevant markets.

The regression equation for each grouping is calculated in its natural log form, and the results are presented in table 4. As illustrated, the explanatory variables have the expected signs. For each grouping, local market concentration increases with decreases in population and with the introduction of state banking laws allowing multibank holding companies and limited branching. In the second and third groupings, where size of county is introduced, concentration increases as the space within the relevantly defined markets decreases.

Unfortunately, there is some variation in the statistical significance attached to these variables in explaining levels of local market concentration. Population within the relevantly defined market area is a significant explanatory variable irrespective of the market grouping chosen. This supports the conclusion of the nonparametric test of population and concentration presented in the preceding section.

The presence or absence of state branching laws also is significant in explaining local market concentration using each market grouping. Its statistical significance declines somewhat, however, when applied to the 120 Eighth District markets that cover one or more whole counties, compared with its impact in the other two groupings.

The performance of the size of county and multibank holding company variables is mixed. Size of county is significant for the 598 county markets grouping, but not for the 120 Eighth District markets covering one or more whole counties. Likewise, while multibank holding company laws are statistically significant in explaining concentration where markets are defined to be single counties, they lose their explanatory power when applied to the two groupings derived from the Federal Reserve Bank of St. Louis market definitions.

Thus, the results of the evaluations suggest that branching laws tend to significantly increase local market concentration. The impact of multibank holding company laws is unclear; its significance depends upon how the market is defined.

The results in table 4 indicate the problems inherent in determining useful definitions of banking markets. While the explanatory variables perform best when the markets are defined along single county lines, the categorical definition of a county as a market is conceptually empty. It takes no account of the actual state of interseller rivalry; yet, the notion of interseller rivalry represents the underlying reason for measuring market concentration in the first place.

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[17]Arkansas, Indiana, Kentucky and Tennessee allowed county-wide branching. Mississippi allowed branching within 100 miles of a bank's home office.

[18]The observation date for the third grouping of markets is December 31, 1981. Total deposit data are from "Report of Condition," December 31, 1981. Total deposits for each banking organization in Mississippi on this date are listed according to the location of the organization's main office and are not disaggregated according to branches in different counties. Population and square miles of county data are from the *1980 Census of Population* sources listed in footnote 15. When a market equals a single county, the size of the market is equal to the square miles of the county. For those markets in the second grouping that equal two or more whole counties, the size of the market is equal to the sum of the square miles of the relevant counties.

Table 4
Evaluation of Factors Affecting Local Market Concentration

Grouping One: 164 Eighth District Local Commercial Banking Markets That Do Not Cross State Lines

$$\ln HERF = \underset{(1.46)}{-0.1928} - \underset{(9.99)^{**}}{0.3748 \ln POP} + \underset{(1.28)}{0.0861 MHC_D} + \underset{(3.92)^{**}}{0.2570 BRN_D}$$

$R^2 = 0.4015$

Grouping Two: 120 Eighth District Local Commercial Banking Markets That Do Not Cross State Lines and That Consist of One or More Whole Counties

$$\ln HERF = \underset{(5.47)^{**}}{2.8828} - \underset{(6.57)^{**}}{0.3497 \ln POP} - \underset{(1.24)}{0.1009 \ln SQM} + \underset{(1.21)}{0.0932 MHC_D} + \underset{(2.42)^{*}}{0.1785 BRN_D}$$

$R^2 = 0.3811$

Grouping Three: 598 Counties in Eighth District States, Excluding Mississippi

$$\ln HERF = \underset{(10.48)^{**}}{2.5602} - \underset{(19.50)^{**}}{0.3170 \ln POP} - \underset{(3.45)^{**}}{0.1289 \ln SQM} + \underset{(3.56)^{**}}{0.1177 MHC_D} + \underset{(13.92)^{**}}{0.4742 BRN_D}$$

$R^2 = 0.5559$

Absolute values of t-ratios shown in parentheses.
** = significant at the one percent level.
* = significant at the five percent level.
HERF = H-index value in each market.
POP = Population within each market.
SQM = Square miles per county or counties.
MHC_D = 1, if market is located in a state which allows multibank holding company acquisitions.
= 0, otherwise.
BRN_D = 1, if market is located in a state which allows limited branching,
= 0, otherwise.

SUMMARY AND CONCLUSIONS

The majority of Eighth District local commercial banking markets are highly concentrated, as the term is defined by the Department of Justice. Also, relatively higher levels of concentration can be expected in local markets with smaller populations of users, and located in states that allow limited branching. The effects on concentration of state multibank holding company laws and the physical size of a market, however, are ambiguous.

In 1982, banking and finance ranked first among 50 industries for merger activity.[19] This, coupled with the extent to which local banking markets fall into the "highly concentrated" category, suggests that future bank mergers and acquisitions may well be likely candidates for closer scrutiny by the Department of Justice. If this becomes the case, it will underscore the need for a clearer understanding of the impact on measured concentration in a market of state branching and multibank holding company laws, population and physical space and alternative criteria for defining that market.

[19]John Morris, "Banking Had More Mergers In '82 than Any Other Group," *American Banker*, January 19, 1983, p. 2.